

A STUDY OF SERUM ZINC, SELENIUM AND COPPER LEVELS IN CARCINOMA OF ESOPHAGUS PATIENTS

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ABSTRACT

The association of serum trace elements like selenium, zinc and copper has been found in different types of cancer. This study was conducted to see the serum level of these three trace elements in cancer esophagus patients. Biopsy confirmed cancer esophagus, 24 patients (12 males, 12 females, mean age 54.5 ± 11.65 year with 23 healthy subjects (16 males, 7 females, mean age 44 ± 13.82 years) were included in this study. Both control and study group patients were of same socio-economic status and dietary habits. Serum zinc and copper level were estimated using standard absorption spectrometer technique and serum selenium by Hydride generation method.

We observed significant low serum levels of zinc and selenium while high level of serum copper in carcinoma esophagus patients, as compared with normal healthy controls. This shows an association of serum selenium, zinc and copper with cancer esophagus.

KEY WORDS

Cancer esophagus, Serum Zinc, Copper and Selenium, Atomic absorption spectrophotometer, Hydride generation, A.A.S.

INTRODUCTION

Cancer esophagus incidence is higher in foot hills of Himalaya, Assam, Punjab, Northern Karnataka, Madhya Pradesh and Northern Karnataka. In India it accounts for 5-7% of total cancer (1). The association of serum trace elements and high cancer risk has been found in many studies (2, 3, 4, 7). Miyamoto *et al.* (10) observed that serum selenium was significantly lower in lung cancer ($P<0.01$) in Japan. Sullivan F. *et al.* (11) found that serum selenium and zinc levels were low while copper level were high in various human cancers in west Virginia. Mark *et al.* (2) found that human squamous cell carcinoma esophagus patients had a significant low level of serum zinc as compared with age matched healthy controls ($P<0.01$). Umesh Kapil *et al.* (India) (12) observed that 53% of study people (Jharkhand) had serum zinc deficiency and the deficiency was higher in females as compared

to males. Limited data are available in India to show the association of cancer esophagus with serum level of trace elements (Zn, Copper, Selenium). These trace elements although present in minute quantities in human blood, play a vital role in many biochemical enzymatic reactions and have been examined critically as a potential key factor in various human disease including cancer. Selenium is one of the major non enzymatic antioxidant in human body. This hospital based study is aimed to see the blood (serum) level of Zn, Se, Cu in cancer esophagus patients.

MATERIAL AND METHODS

The study group consisted of 24 patients (12 male, 12 female) of esophageal carcinoma. All patients were of squamous cell carcinoma histology. The control group consisted 23 healthy subjects (16 male and 7 female). The mean age in patients group was 54.5 ± 11.65 yr. (range 35-83 yr) and in control group it was 44 ± 13.82 yr (range 22-70 yr.). Both study and control group were of same socio-economic status with similar diet habits. The criteria for the selection of patients were :-

- (i) Biopsy Proved cases of esophagus cancer.
- (ii) Who had not undergone any treatment i.e. chemotherapy or radio-therapy.

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- (iii) Who did not suffer from any major illness in the past.
- (iv) Who has not taken long course of any mineral supplement during last six months.

The criteria for selection of controls :-

- (i) Who were not suffering from any cancerous lesions.
- (ii) Who has not taken any course of mineral supplement.
- (iii) Belong to same socio-economic status and same diet habits.

Individuals in the control group were matched with the patients for their place of residence and sex. Blood samples were obtained by vein puncture, between 8 and 9 AM after overnight fast. Standard precautions for trace element determination were taken, samples with signs of hemolysis were discarded. The blood was centrifuged at 3000 rpm for 15 minutes (4°C) and serum was stored at -4°C until the day of the test. Fasting serum zinc and copper concentration were determined by direct measurement method using atomic absorption spectroscopy (5). The determination of selenium concentrations was done by hydride generation method (6). Serum was digested by a mixture of nitric and perchloric acid. After hydride generation and using a sodium borohydride method, the selenium concentration was determined (AAS Model ECI 4141). Analytical reagent grade chemicals, standards were used. Water used for washing laboratory apparatus and for preparing solutions and standards was purified by deionization of redistilled water.

RESULTS

The results as presented in the table 1 and Fig. 1 show that the levels of trace element were altered in subjects having esophageal cancer.

Copper :- This metallic ion was significantly increased in serum of patients as compared to its level in normal control group of individuals ($P<0.001$).

Zinc:- Mean plasma zinc level was significantly lower in the esophageal cancer group than the healthy control group ($P<0.001$).

Selenium:- There was a statistically significant difference in the mean selenium levels in the esophageal cancer patients and control ($P<0.01$). Its serum level is lower in cancer esophagus patients.

DISCUSSION

The findings of the present study indicates a strong association of Zn, Cu and Se with esophageal

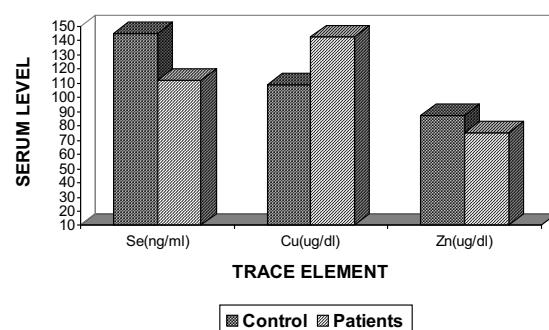


Fig. 1.

Table 1. Observation table (mean values \pm SD)

	Se (g ml^{-1})	Cu (g dl^{-1})	Zn (g dl^{-1})
Control Group	0.145 \pm 0.047	108.69 \pm 16.47	87.17 \pm 6.43
Patient Group	0.112 \pm 0.032	142.16 \pm 18.72	75.20 \pm 5.57

cancer. In cancer esophagus there are significantly lower serum level of Zn and Se and higher level of Cu as compared to the controls. Mark *et al.* (2) observed similar results in which the esophageal cancer patient had significantly lower Zn and Se level and higher serum Cu level as compared to the control subjects. In lung, colorectal, cervix, larynx cancers also their levels were found to be altered (3, 4, 10, 11). Zinc and copper are important microelements which not only regulate the physiological functions of various organs but are also associated in the production of pathological changes in these organs. Serum copper values are significantly elevated in many diseases e.g. chronic obstructive pulmonary disease (COPD), malignancy and psychosis (11).

Zinc is mainly required for DNA synthesis, cell division and protein synthesis. Zn directly stimulates DNA synthesis by altering the binding of F and F3 histones to DNA so as to affect RNA synthesis. It has been hypothesised that Zn could be operating at several different levels and influencing lymphocyte monoclonal proliferation (8).

Selenium is important in the active centre of the Se-dependent GSH-Px. This enzyme has four subunits and each contains one selenium atom. It was suggested that selenium protects cell by inhibiting free oxygen radical production. Moreover an important antioxidant Vit. E is transported by selenoproteins. There is evidence for a direct relationship between GSH-Px activity and carcinogenesis (9).

Some human epidemiologic studies showed that a low Se concentration in serum increase the risk of human cancer (cancer of the stomach, esophagus, colon, lung, prostate and breast) (10).

Our data does not allow us to conclude whether Zn, Se deficiency and Cu level, preceded or occurred as a result of the cancer. However the low mean serum Zn, Se and high Cu levels in esophageal cancer patient as compared to the controls indicated the strong association with esophageal cancer in the Indian population.

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